

Future Directions



12.1 INTRODUCTION

The Tucson Active Management Area (AMA) faces a number of major challenges in meeting the safe-yield goal and addressing key water supply issues. The Tucson AMA has a diverse economy and is growing rapidly. Residential, commercial, and industrial growth is occurring at a record pace with similar projections for future years. Water use patterns in most sectors are showing corresponding increases. The Tucson area's water management issues are in part political, but the effects of rapid growth and groundwater overdraft are real and must be addressed. Safe-yield is achievable in the Tucson AMA, but only if regional efforts to maximize use and storage of CAP and effluent are successful.

This Future Directions Chapter is intended to provide perspective on resolving the long-term water management issues in the Tucson AMA. It also presents for consideration potential future activities and alternatives that address key issues, assist in the achievement of safe-yield, and establish the framework for long-term water sustainability. Many of the concepts discussed in this chapter fall outside the Arizona Department of Water Resources' (Department) responsibility or authority. Responding to the challenges in meeting safe-yield may require institutional and legislative changes or revised management approaches.

Significant progress has been made in management of water supplies. Over the course of the second management period, many new programs, rules and laws were adopted to aid in the distribution, conservation, augmentation and management of the state's water supplies within AMAs. During the third management period, the Department will continue to develop new approaches to move the AMAs closer to their management goals and to protect water supplies for future use.

The Third Management Plan was developed by building on programs that were incorporated in the First and Second Management Plans. The Third Management Plan also incorporates new programs that will result in incremental progress towards achievement of the safe-yield goal. Most importantly, it identifies alternative strategies for consideration in moving towards attainment of safe-yield. Development of the Third Management Plan involved the following steps: (1) issue identification and data base development, (2) development of alternative programs to address the issues, (3) analysis of alternatives, (4) program development, and (5) publication of the draft plan. Although these activities form a solid basis for future planning, additional efforts may be required to achieve statewide and local management goals.

12.2 THE DEPARTMENT'S PERSPECTIVE ON WATER MANAGEMENT IN THE TUCSON ACTIVE MANAGEMENT AREA

Groundwater use in the Tucson AMA currently exceeds the rate of natural and incidental recharge by a factor of two. The water budgets in Chapter 11 illustrate that based on current projections of water use, the Tucson AMA may not achieve safe-yield by 2025 unless additional management efforts are undertaken. Attainment of safe-yield will require optimal use of Central Arizona Project (CAP) water and effluent currently available to all municipal users in the AMA in place of groundwater. However, there are many physical, institutional, and financial impediments to full utilization of these supplies. In addition, agricultural and industrial water users are not required to use renewable water supplies. These entities hold substantial groundwater rights that are projected to remain in use beyond the year 2025.

Even if additional progress is made towards the basin-wide goal of safe-yield, there is an increasing concern that, if groundwater withdrawals continue at existing levels, there may be localized impacts and threats to long-term supply reliability in certain areas. Groundwater resource management conducted on a smaller scale than AMA-wide may be considered as a means to address concerns of a more local nature, such as subsidence and depletion of water supplies. Although safe-yield is an attainable goal, it is apparent that sufficient progress has not been made toward this goal, nor have the statutory and institutional structures necessary to succeed been fully established. For these reasons, the water interests in the state and the AMA may need to redefine their goals and the tools available to attain them.

12.2.1 The Safe-Yield Goal

In theory, safe-yield is a balance between groundwater withdrawals and recharge, resulting in stabilizing water levels on an AMA-wide basis over time. In practice, safe-yield is a much more complicated concept. Aquifer water levels are affected by underground storage and recovery activities, aquifer compaction due to subsidence, and use of groundwater allocations made through the Assured Water Supply Program (AWS Program). Under these conditions, water levels may never completely stabilize. (The complexities are more fully described in the preface to section II.) Although the specifics of calculating safe-yield are daunting, the theory of safe-yield is simple. It is closely related to the concept of sustainability, which means that resource availability does not diminish over time. Safe-yield is entirely consistent with the goal of ensuring long-term, reliable water supplies.

Support for the safe-yield goal remains strong in the Tucson AMA, but concerns exist regarding inequities in the allocation of costs and benefits within and between the water-using sectors that may require a re-evaluation of current water management approaches. In particular, there are concerns that the municipal sector is the only sector that is required to bear the cost of utilizing renewable supplies. The municipal sector is required, through the Assured Water Supply Rules (AWS Rules), to develop and use renewable water supplies. Neither the agricultural nor the industrial sectors have similar requirements. In addition, there are structural weaknesses in certain portions of the Groundwater Code (Code) because few of the Code provisions are tied directly to achieving the goal.

There are now multiple tools and agencies (the AWS Rules, the Central Arizona Water Conservation District (CAWCD), the Central Arizona Groundwater Replenishment District (CAGR), and the Arizona Water Banking Authority (AWBA)) that are designed to address specific portions of the water management agenda. Additional tools are likely to be developed in the future. The Department intends to assist in coordinating these agencies and their activities with a focus on achieving safe-yield and other AMA management objectives.

12.2.2 Critical Area Management

In addition to achieving the AMA-wide safe-yield goal, there may be a need to focus on particular water management needs in specific geographic areas of the AMA if significant declines in groundwater levels continue into the future. Hydrologic conditions vary widely within the Tucson AMA, ranging from areas with rising groundwater levels to areas of serious overdraft. Access to renewable water supplies is not uniform throughout the basin. If groundwater withdrawals continue at existing levels, land subsidence due to water level declines and resulting aquifer compaction is now considered to be likely in some areas, while other parts of the AMA are not expected to be affected. Water supply reliability is a concern for most municipal providers, but some have more options than others.

In order to address the variety of localized water-related concerns, water management tools and processes may need to be developed that are designed to address long-term water issues on a subregional or “critical area” basis. The Department, in cooperation with the water users in the AMAs, intends to investigate the concept of a critical area management program as a high priority during the third management period. However, if currently planned reductions in groundwater withdrawals occur in the near future or if replenishment occurs within the area of hydrologic impact of groundwater withdrawals, there may be no need to consider additional regulatory authority.

12.2.3 Under-Utilization of Available CAP Supplies

CAP water is the primary augmentation supply for the Tucson AMA. Although a total of 215,333 acre-feet of CAP allocations are available to the region, and additional use of excess CAP water is possible, a number of circumstances have limited use to a level far below Second Management Plan projections. The

largest single difference in the projected versus actual demand is in the City of Tucson's CAP water utilization level.

The City planned to be using its entire allocation (138,920 acre-feet after transfer of 9,500 acre-feet to two northwest AMA providers) through direct potable delivery and recharge by 1995. Actual City use (through agricultural exchanges) in 1995 was 10,000 acre-feet and was accomplished through groundwater savings projects after direct delivery was halted. The City has made substantial progress since 1995 in developing large recharge facilities at Pima Mine Road and in the Avra Valley, and these projects should significantly increase the City's use of CAP water within the next few years.

Other water users in the basin have also not fully utilized available CAP water. Agricultural use of CAP water in the basin has occurred through a number of groundwater savings projects sponsored by municipal users. Like the City of Tucson, some other municipal users are directly recharging a portion of the CAP water available and have plans to develop additional recharge capacity. In spite of these efforts, CAP water use remains at a much lower level than anticipated.

Public perceptions of CAP water quality have been strongly affected by the brown color, taste, and odor problems associated with some of the initial deliveries by Tucson Water. Although the treatment and delivery difficulties encountered by the City have reportedly been corrected, the public's perceptions will be much more difficult to overcome. Water quality issues associated with CAP water itself and with treatment strategies for this supply are expected to continue to be of major concern to the public within this AMA and ultimately will affect all municipal water providers in the basin.

Although this short-term under-utilization of CAP water may not directly endanger the long-term goal of safe-yield, CAP water use and storage during the third management period is a key component of the region's management strategy. Stored CAP water will be needed to provide a buffer for droughts in future years. The region ideally should be making greater use of CAP water during the period of time when CAP water availability is at its peak and when the cost of CAP is relatively low. It is possible that the large groundwater allocations allowed under the AWS Rules and the slow contractual phase-in of replenishment requirements for CAGR members provide more flexibility than is needed in the short term.

The Department will continue to evaluate mechanisms to increase CAP water utilization in the short term. Most solutions will require substantial commitment by water users and water providers.

12.2.4 Conjunctive Use and Management of Supplies

The Code provides a strong regulatory approach to groundwater management within AMAs, but a more comprehensive yet flexible approach may be required to meet water management objectives. Water management is currently fragmented because effluent, CAP water, surface water and groundwater are all regulated differently and owned or controlled by different jurisdictions. This fragmentation exacerbates political issues in the Tucson AMA, particularly those associated with ownership of water supplies. The ability to conjunctively manage all water supplies while working towards a safe and reliable water supply for the future is a logical long-term goal. In addition, a more comprehensive approach to water management could consider objectives such as protection of riparian habitat, sustainability and other quality of life issues.

Although the Department does not currently contemplate a major legislative agenda to address conjunctive management, it is appropriate to evaluate opportunities to move in this direction.

12.2.5 Implications of Indian Water Rights Claims

Water management in the Tucson AMA is complicated by unresolved Indian water rights claims. The major non-Indian water users in the basin have been working with the Tohono O’odham Nation and the federal government since the late 1970s to resolve claims for damages to water rights of the San Xavier and Schuk Toak Districts resulting from off-reservation groundwater pumping. Failure to implement the Southern Arizona Water Rights Settlement Act (SAWRSA) leaves major questions about water supply and demand unanswered. Since the activities of off-reservation water users affect on-reservation conditions and vice-versa, it is necessary to improve the coordination of water management across reservation boundaries.

The Department will continue to assist the negotiating parties in seeking a final resolution of Indian water rights issues and in establishing cooperative programs with the Tohono O’odham and the Pascua Yaqui. In the course of these efforts, there may be opportunities to pursue water management projects that benefit water users both on and off the reservations.

12.2.6 Integration of Water Quality Management

Water quality problems must be addressed with both public health and water supply management needs in mind. Opportunities to match end uses with supplies of different qualities and efforts to maximize the beneficial use of treated water associated with remediation are integral to efficient management of our water resources. The following areas specifically need close coordination between the Arizona Department of Environmental Quality (ADEQ) and the Department:

- Development and implementation of ADEQ effluent reuse regulations
- Participation in the design of remedial action projects, including the type and amount of beneficial end uses
- Evaluation of the impacts of incentives for remediation, including the conservation requirement exemption and the assured water supply groundwater account exemption of 65,000 acre-feet statewide in light of AMA-wide and local area water management goals

The Department’s goal is to ensure that end uses of treated water do not conflict with achievement of the AMA water management goals. The Department’s increased role in ADEQ’s remediation programs and better integration of the databases of the two agencies are steps forward in this coordination effort. The Department intends to continue working towards increased coordination between the two agencies.

12.2.7 Economic Considerations

Water management strategies must be analyzed from the perspective of equitable apportionment of total costs and benefits to the community, not just the costs and benefits to an individual or utility. Water management decisions must be economically justified, taking into consideration the long-term needs and concerns of the community. As has become apparent in recent debates regarding the use and treatment of CAP water in the Tucson area, adequate information about total costs to consumers and the community is vital to long-term decision-making.

In addition, although groundwater is of higher quality and is more reliable than renewable supplies, it costs less. The price that is paid for groundwater is based only on the production costs and does not reflect its full value. The economic incentives to use groundwater are in conflict with the long-term goals of maintaining a reliable water supply for the community. However, there are limited opportunities for the Department to affect the price structure for water users. One option that could be considered, but is

unlikely to be supported in the context of the state's legal and political institutions, is to increase groundwater withdrawal fees to reflect the full value of groundwater.

12.2.8 Integration of Land Use Planning with Water Policy

A closer association between land use planning and water policy needs to be established. County and local land use and economic development planning programs must continue to plan for and incorporate water supply and infrastructure requirements as well as conservation objectives. Principal areas of concern include the following:

- The need to secure and utilize renewable water resources that meet AWS Program criteria for developing areas
- Strategic location of wastewater treatment facilities and underground storage facilities to maximize the use of renewable water sources and to stabilize the local area aquifers
- Identifying groundwater characteristics in local areas that may impact the community; including changes in depth to groundwater, water quality changes, and land subsidence
- Evaluating the water resource implications of development occurring on desert land rather than on retired farmland
- Evaluating water use as a factor in economic development decisions by considering such factors as jobs created per gallon of water used, ability to utilize effluent or remediated water, quality of effluent generated, ability to develop aggressive reuse programs, etc.

The Department may be able to assist in this process by providing relevant water demand and supply information, scenario analysis using hydrologic models, and planning assistance. Each of the areas above need to be more closely linked to local general plans, zoning, infrastructure development, and other development decisions.

12.2.9 The Need for Community Support

Community support is a key component in the development of any program, but it is particularly important in water policy. The quality, quantity, and cost of the water supply is an issue that concerns virtually every citizen, and its importance in the Tucson area cannot be overstated. Although most citizens are concerned about water issues, many are not aware of the critical nature of current groundwater overdraft conditions in the AMA. The public is likely to focus on growth and visible water uses such as golf courses as the cause of the problem, without recognizing that current groundwater users in every sector already exceed the natural groundwater replenishment rate. Equity considerations must move beyond the needs of current water users, and the community must begin to consider ecological values and the needs of future generations.

The Department will continue to work with advisory groups, public citizens, and elected officials to initiate and develop programs that are supported by the community.

12.3 CHALLENGES TO ACHIEVING SAFE-YIELD AND DEPARTMENTAL STRATEGIES IN RESPONSE

This section identifies some of the factors limiting achievement of safe-yield, and the Department's proposed role in addressing these problems.

12.3.1 Residual Overdraft by Existing Users

Municipal, industrial, and agricultural users are all expected to continue to pump groundwater through 2025. Most municipal water supplies will be delivered by designated water providers who are required to utilize renewable supplies but are authorized to pump some “allowable” groundwater. However, the ongoing pumpage associated with undesignated providers (water companies without an assured water supply) is about 21,000 acre-feet per year. In the agricultural sector, most of the demand is expected to continue to be supplied by groundwater, with total demand projected to be 68,500 acre-feet per year in 2025.

The industrial sector is likely to be responsible for a significant component of the groundwater overdraft. If current projections of copper mining activity are correct, copper mines alone could be responsible for 47,000 acre-feet of groundwater use in 2025. Any evaluation of the tools available to reach safe-yield must address the problem of continued groundwater pumpage by grandfathered right holders and by undesignated water companies past the year 2025. An additional consideration is the need to sustain safe-yield once it has been achieved.

The Department will initiate a discussion of these issues and potential mechanisms to address residual overdraft by existing users.

12.3.2 Community Conflict

An obstacle to utilizing renewable supplies is conflict within the Tucson community. Although specific problems such as the City-County 1979 Intergovernmental Agreement concerning effluent are frequently cited, there is a general lack of trust between certain water interests. Conflicts over ownership of effluent, CAP utilization, assignment of costs and benefits associated with the reclaimed water system, and other issues have resulted in numerous legal actions, political battles, and lost opportunities. Opportunities for utilization of renewable supplies are available now, but are likely to become more limited in the future. The public is confused by conflicting information they receive. Lack of a common vision affects the community’s ability to utilize these supplies and to present a united front at the local, state, and federal levels.

12.3.3 Inadequate Information

A major shortcoming of water management efforts to date is providing accurate information to the public; it is difficult to ensure that the media and other sources report information accurately. There is a lack of knowledge of the basic facts of water supply and water quality that severely constrains the ability to achieve consensus on water management issues.

In addition to the problems of adequately communicating broad concepts to the public, experts disagree on some specifics. The Regional Recharge Planning effort has addressed some of these issues. The development of the Tucson AMA’s hydrologic model will provide a tool for scenario analysis and graphic displays of current and future conditions. The recent initiation of regional subsidence and aquifer storage monitoring should substantially increase our understanding of subsurface hydrology. The Department intends to expand its outreach efforts and will continue to share its extensive data on water levels, water use, water rights, and other water management information with water experts and the public.

12.3.4 Need for Continuing Conservation Efforts

Safe-yield and sustainable water use can only be achieved through some combination of efficient use of renewable supplies and reduced demand. The Tucson area has historically been supportive of conservation programs, but this commitment to demand reduction must be continued and expanded in the future.

General confusion about the water picture in Tucson may have lessened the opportunities for individuals to understand the role their own personal decisions play in the broader resource picture. It is the collective decisions of individuals regarding landscape type, the need for water-requiring amenities such as pools and misting systems, and other water-using appliances that affect the gallons-per-capita use of each municipal provider. Strategies such as water harvesting, proper management of irrigation systems, and changes in personal water use habits require ongoing commitment at the individual level.

Although there have been expectations that construction of new housing units using low water use fixtures and landscaping would reduce the average water use in most water provider service areas, in some areas new units are using more water than anticipated. It is likely that the conservation message is not reaching homeowners when they are making key long-term decisions about water-using fixtures and landscaping in new homes. It is possible that media reports regarding availability of excess CAP water and general frustration with water management efforts are affecting water use patterns.

Although the availability of excess Colorado River supplies is expected to continue in the short-term, shortages on the Colorado River are expected to affect deliveries in Arizona thirty years out of the next 100. Perhaps more important is the fact that Colorado River supplies are projected to be cut back 50 percent of the time after 2050. It is much easier to achieve conservation objectives if people perceive there is an imminent water supply problem, or if they are aware of the long-term supply issues. Conservation goals need to be reinforced through pricing structures, ordinances, and public information about the serious long-term nature of water supply limitations in the area.

The Department continues to believe that conservation efforts are an appropriate water management technique. The Department's programs are focused in the areas with the greatest conservation potential and in sectors that are expected to continue using mined groundwater. This focus on the future will provide substantial dividends over time.

12.3.5 Regulation of Private Water Companies

Private water companies have repeatedly pointed out that they have difficulty meeting AMA requirements and contributing to achieving the safe-yield goal. This situation occurs because of a lack of regulatory authority over their customers' water usage and because of perceived conflicts between the Department's objectives and decisions of the Arizona Corporation Commission (ACC), which controls the water rates in these service areas. There have been ongoing discussions between the Department and the ACC concerning pass-through of investments in renewable supply use and conservation program costs. The policies and procedures of the two agencies regarding these matters are not effectively integrated. Some issues may be resolvable in the context of a strong, ongoing commitment from both agencies. Other issues may require resolution through statutory changes.

12.3.6 Important Factors not Affected by Regulatory Programs

Many of the decisions that affect the ability to achieve safe-yield are outside of the influence of current regulatory programs. Economic factors have a strong influence on water use. For example, as world copper prices rise and fall, there is a direct effect on copper production in the mines in the Tucson AMA. Likewise, irrigated acreage has responded dramatically to changes in crop prices and federal subsidies. As was illustrated in the sensitivity analysis in Chapter 11, a change in population growth rates could have a dramatic effect on total water use. However, under the AWS Rules all new subdivisions must utilize renewable water supplies, so the impact of population growth on groundwater demand and hence safe-yield is negligible so long as sufficient renewable supplies are available.

Water costs strongly influence the rates of water use in all sectors, but there are few opportunities for the Department to significantly affect pricing structures to reduce demand. The cost of using groundwater

should reflect the cost of overdrafting the aquifer. These costs include the loss of a supply, land subsidence and aquifer compaction, water quality degradation, and future alternative water supply sources.

Water supply utilization associated with Indian settlements such as SAWRSA also may affect the regional ability to reach safe-yield. However, the use of these supplies is outside of the jurisdiction of the Department and the Code.

12.4 EVALUATION OF ALTERNATIVE APPROACHES

Overcoming some of the challenges to achieving safe-yield may require legislative or rule changes. The Department will work with regional entities to identify optimal responses to the problems that have been identified and the timeframe within which these responses are necessary. In order to develop a consensus response, a number of committees or task forces will be established to work on solutions. In the Phoenix and Tucson AMAs, a broad range of issues has been identified relative to achievement of safe-yield. These issues are both local and statewide in scope. Depending on the subject matter involved, issues identified at the AMA level could be considered at the state level if more than one AMA is affected by the problem or could benefit from the proposed solutions. The “big picture” issues relating to the basic structure and effectiveness of Groundwater Code provisions will be addressed at the state level with representation of each major water-using sector and each AMA. The director has committed to working with the Governor to develop a multi-AMA task force proposal that is representative, equitable, and efficient.

One area that clearly merits further discussion in the Tucson AMA is development of the “critical area” concept. In this context, specific problem areas within the AMA could be targeted with incentives for recharge, restrictions on new pumpage, enhanced monitoring, or regional planning and technical assistance. Specific tools and authorities could potentially be developed, such as limiting new uses in the area. The impact of new exempt wells in critical areas may need to be evaluated. Activities of the CAGR and AWBA might be expanded to allow for replenishment on behalf of certain users who are not currently able to participate. Such activities could be focused in critical areas as well.

12.5 IDEAS FOR CONSIDERATION IN FUTURE DISCUSSIONS REGARDING SAFE-YIELD AND CRITICAL AREA MANAGEMENT

There are a number of issues that will need to be addressed to achieve safe-yield and the other water management objectives discussed in this chapter. This section lists ideas and potential activities to address inadequacies in existing programs and suggests new authorities that could be used to address critical areas within the AMA.

12.5.1 Resolving Issues in Attaining Safe-Yield

The options that are listed below, in some combination, can address problems associated with achieving safe-yield on an AMA-wide basis:

To address ongoing (residual) pumpage by existing users:

1. Re-evaluate the effectiveness of various Code provisions in making progress toward achieving safe-yield, addressing sectors that are expected to cause ongoing groundwater depletions. Develop programs and authorities to ensure that all groundwater pumpers contribute to achieving safe-yield.
2. Re-examine the ability of irrigation grandfathered rights to be converted in the future to Type 1 non-irrigation rights with no replenishment obligation.

3. Reduce groundwater mining by General Industrial Use (GIU) permits either through pumpage limitations or a replenishment obligation.

To address under-utilization of renewable supplies:

1. Address the disparity between the cost of groundwater and the cost of renewable supplies.
2. Develop incentives for utilization of renewable supplies that are consistent with overall management objectives.
3. Encourage the CAGR to expand its authority and to develop appropriate and equitable financing mechanisms to replenish supplies for members and non-members
4. Increase public education efforts targeted towards local officials, the general public, community groups, and the development community.
5. Evaluate conjunctive management approaches, including revised authorities, incentives and other mechanisms.
6. Encourage cooperative projects that will result in use or storage of renewable supplies.

To prevent new uses of groundwater from exacerbating existing overdraft:

1. Limit or require replenishment by new residential growth that is not subject to the AWS Rules including small dry-lot subdivisions, existing undeveloped lots, and new subdivisions of less than six lots. These categories of development are currently not required to use renewable sources of water, demonstrate physical water availability, or undergo well impact analysis when drilling exempt wells.
2. Evaluate replenishment requirements for undesignated municipal providers and re-evaluate allowable groundwater pumping by designated providers.
3. Ensure that all water users associated with a development plan, including associated golf courses, are required to meet the assured water supply restrictions.
4. Limit new GIU permits.
5. Re-examine the assured water supply depth-to-water rule that currently allows groundwater levels to decline to 1,000 feet below the land surface over 100 years. This depth to water may result in water quality problems, subsidence, and earth fissure development. This rule limit may need to be raised to avoid substantial damage to the aquifer.
6. Restrict ability of new industrial users such as golf courses to use groundwater supplies.

To improve databases and understanding of hydrologic conditions:

1. Continue to monitor land subsidence in the AMA.
2. Identify and quantify existing problems created by excessive pumping, which include land subsidence and earth fissures, aquifer compaction, water quality degradation, declining groundwater levels, and physical availability problems under the AWS Program.

3. Develop groundwater modeling capabilities to allow testing of alternative planning scenarios, including prediction of the extent and rate of subsidence. The ability to correlate pumping and soil conditions to land subsidence rates would be an invaluable tool in a rapidly urbanizing area.

12.5.2 Resolving Issues Regarding Critical Area Management

All of the ideas and potential activities described above to address AMA-wide water management issues pertain to critical area management as well. The options listed below could address water management problems in specific “critical areas” within AMAs.

1. Obtain the authority to protect water recharged in critical areas but recovered outside the area of impact, and to protect non-recoverable storage from pumpage by new users and existing residual users who do not shift onto renewable supplies. A.R.S. § 45-856.01.
2. Provide the ability to manage water levels in critical areas by restricting pumpage using the following mechanisms:
 - Limiting new GIU permits and industrial users in critical areas
 - Restricting the ways in which new service areas can be established
 - Limiting Type 1 non-irrigation grandfathered right conversions
 - Increasing the level of conservation requirements
 - Buying out or providing incentives for extinguishing existing grandfathered rights in specified areas
 - Limiting new exempt wells
3. Encourage the CAGR D to develop equitable financing mechanisms that enable replenishment in critical areas or near the location where the groundwater pumping obligation was incurred.
4. Require groundwater pumpage that is to be replenished by a conservation district that provides replenishment services to be consistent with the management plan drawdown criteria in Chapter 8. These criteria currently apply only to storage credits that are recovered outside of the area of hydrologic impact, but could be expanded to address all pumpage that is recharged or replenished in another location.
5. Develop well-spacing rules that have specific provisions to protect critical areas.
6. Provide economic or regulatory incentives to utilize renewable supplies in lieu of pumping groundwater in critical areas.

12.6 CONCLUSIONS

The key to effective water management is to anticipate change and to develop systems that are flexible enough to respond to conditions that are unlike those we experience today. As has been noted many times, the one aspect of the future that is certain is that it will be unlike the past. The ability to identify and understand trends in water use and supply is central to the functions of the Department. It will be necessary to expand basic monitoring programs, improve the management of the data that are collected, and improve hydrologic modeling capabilities in order to effectively manage the state’s water supplies in the context of change. The Department intends to expand its technical and advanced planning capabilities to better serve the State of Arizona and the AMAs in the next management period.

This chapter has set the stage for activities within the Tucson AMA that could contribute to the AMA’s goals and objectives. To ensure safe, dependable water supplies for the existing and future residents of the

Tucson AMA we must efficiently use the renewable water supplies available. Achieving safe-yield and resolving water issues within critical areas of the AMA are major challenges. The ability to meet these challenges is dependent to a substantial degree on community support. New strategies and tools for water management may be required in the Tucson area in order to rebuild public trust. A combination of education, cooperative efforts, and changes in legislation may be required to address water issues in the future. The Department will continue to work with community interests to develop innovative, cooperative solutions and to respond to the area's changing needs.